Distributed Imaging Radar Technology (DIRT)

U.S. Army Space and Missile Defense Command
Space and Missile Defense Technical Center

The Distributed Imaging Radar Technology (DIRT) program is developing technology to give the Army Transformation Objective Force the capability to continuously track and identify battlefield targets such as close combat vehicles and weapons (tanks, artillery, rockets), deep targets (missile transporter erector launchers (TEL), Battle Management Command, Control, Computer, Communications and Intelligence (BM/C4I) nodes, weapon stockpiles), and moving, as well as stationary targets, dispersed on the battlefield under all weather conditions. Currently, standoff aircraft, satellites, and forward-based observers perform these functions, but performance is severely limited by sensor coverage/range/resolution, sensor availability, the availability of unique identification features, and weather degradation of optical sensors.

DIRT will provide the capability to "see" the battlefield in near real-time with high-resolution images of targets with unique target identification as well as the ability to mitigate clutter and jamming across the width and breadth of the area of conflict. DIRT will also provide the warfighter with wide area coverage of the battlefield, continuous tracking of moving and stationary targets, no single point failure, and precision tracking for targeting as well as have the capability of direct handover to defense weapons.

Objectives

- Demonstrate feasibility of continuous imaging over a wide field of view (WFOV) with a Distributed Aperture Radar System
- Develop plans and design for Distributed Aperture Radar Battlefield Imaging System for the Future Combat System (FCS)
- Provide technology transition to reconnaissance, surveillance, and target acquisition (RSTA) for FCS

Concept

A Field of Regard (FOR) will be imaged by steering subapertures mounted on airborne platforms to illuminate the area of interest. The radar system(s) will transmit orthogonal waveforms (nearly simultaneously) from subapertures. The DIRT processing will precisely measure the location and motion of the subapertures phase centers at time of transmission. The radar return is then received at each subaperture. The central DIRT processing node will receive the subaperture returns, location, and time of transmission. These returns will be deconvolved from waveforms transmitted by each subaperture by an optical processor. To select target locations (e.g. Range Cells) in FOR the synchronized time and phase of deconvolution of the waveforms must be performed and then moving target indicator (MTI) processing and compensation for the Doppler shift must be accounted for. An image will be constructed over the selected FOR. Within the image ground benchmarks/reflectors can be located. Updated subaperture locations and motion, and compensated time and phase of deconvolved waveforms for location errors can be combined to provide an accurate picture of the FOR. The image can be reconstructed with updated subaperture locations and waveform returns to provide even higher resolution images of the area of interest.

Key Technologies

Space Time Coded Aperture (STCA)

- Waveforms transmitted and recovered simultaneously from distributed subapertures
- Precision time and phase synchronization of transmissions from separate subapertures
- Nearly instantaneous image reconstructed from single set of transmissions from distributed radar apertures

Wideband Waveforms

- Improved range resolution
- Reduced range and angle sidelobe clutter

Radar Optical Processing

- Speed of light processing
- Near real time waveform deconvolution and image reconstruction

For more information, please contact:

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